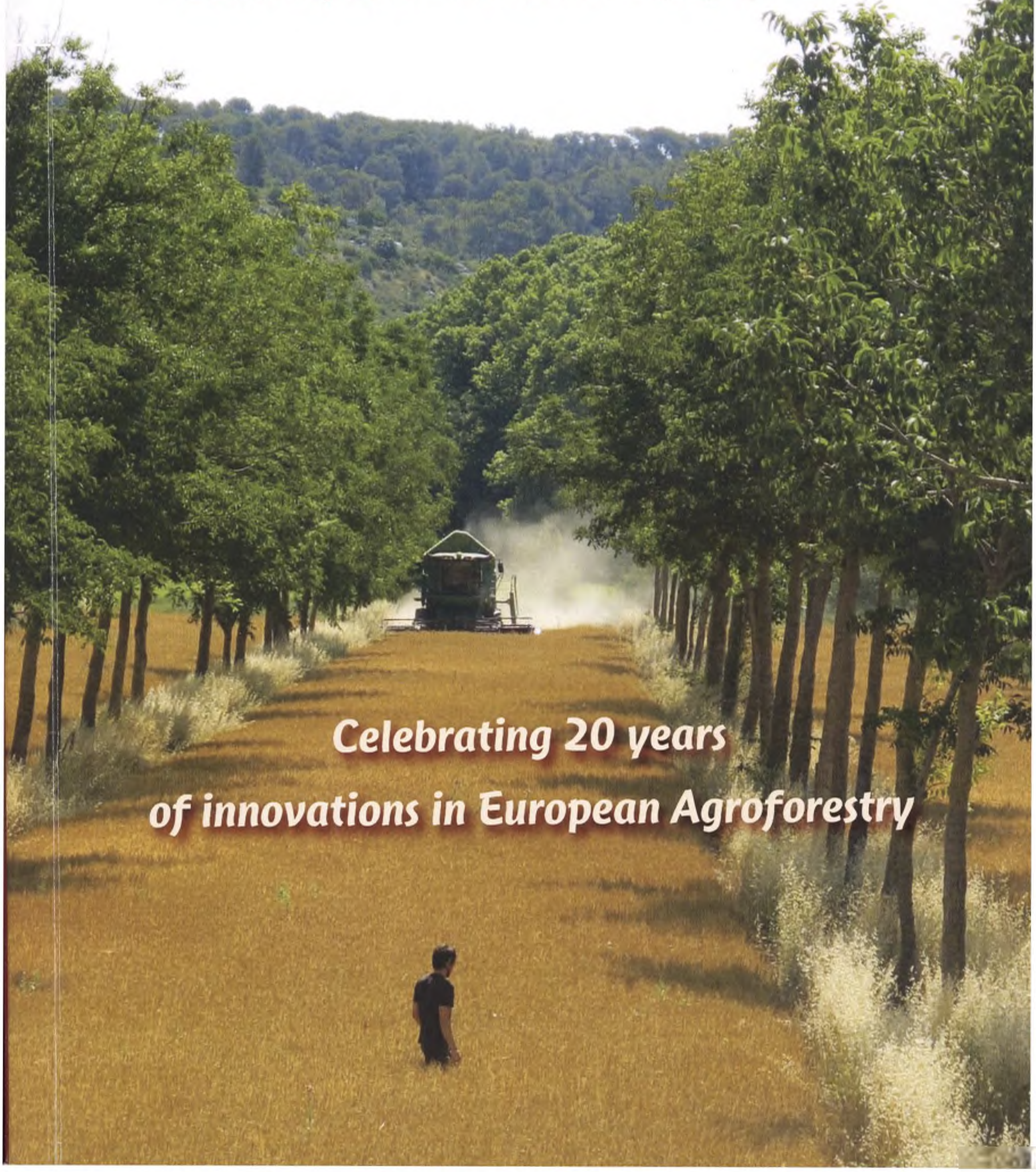
Book of Abstracts

3rd European AGROFORESTRY Conference 2016

23-25 May 2016 – Montpellier SupAgro, France



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EUROPEAN AGROFORESTRY FEDERATION

3rd European Agroforestry Conference

Celebrating 20 years of Agroforestry research in Europe

Montpellier, France, 23-25 May 2016

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LINKING ABOVE - AND BELOWGROUND PHENOLOGY OF HYBRID WALNUT IN TEMPERATE AGROFORESTRY SYSTEMS

Mohamed A[1]*, Monnier Y[1], Mao Z[1], Maeght JL[2], Jourdan C[3], Sabatier S[4], Stokes A[1]

* Correpondence author: awazmsm@yahoo.com

(1) INRA, UMR AMAP, F-34398 Montpellier, France (2) IRD, UMR 242 IEES-Paris c/o Soils and Fertilisers Research Insitute, Hanoï, Vietnam (3) CIRAD UMR Eco&Sols, Montpellier, France (4) CIRAD, UMR AMAP, F-34398 Montpellier, France

Introduction

Climate models predict that an increase in atmospheric CO_2 concentration, precipitation and temperature could affect many biological phenomena and increase the frequency and magnitude of extreme weather events (IPCC, 2007). Root and shoot phenology could be strongly influenced by the variations in soil water content (Wan, C et al.2002; Green,J.J et al.2005), soil temperatures (Steinaker & Wilson 2008 ; Steinaker et al.,2010; Coll et al., 2012) and air temperatures (Tierney.G.L et al.,2003; Fukuzawa et al.,2013). Changes in plant phenology are considered to be a very sensitive and observable indicator of plant responses to climate change (Steinaker et al., 2010). In contrast, very little is known about the relationship between shoot and root phenology especially in the natural soil environment (Harris et al., 1995; Steinaker et al., 2010).

Material and methods

We report shoot and root phenology of hybrid walnut (*Juglans nigra*regia*) in three temperate agroforestry systems, along a climatic gradient (mediterranean, continental and oceanic) of precipitation and temperature in France (**fig.1**). All trees were planted in 1995, 1994 and 1999 in the three climates (Mediterranean, continental and oceanic) respectively. Fine root dynamics were studied using rhizotrons and minirhizotrons. All rhizotrons in oceanic and continental climate placed at 10 to 60 cm soil depth and at 10 to 300 cm soil depth in a Mediterranean climate. Fine roots dynamics were measured using a flatbed scanner and cameras in rhizotrons and circular scanner in minirhizotrons (**fig.2**). The retrieved images were analyzed in the SmartRoot software (Lobet et al., 2012) (**fig.3**).

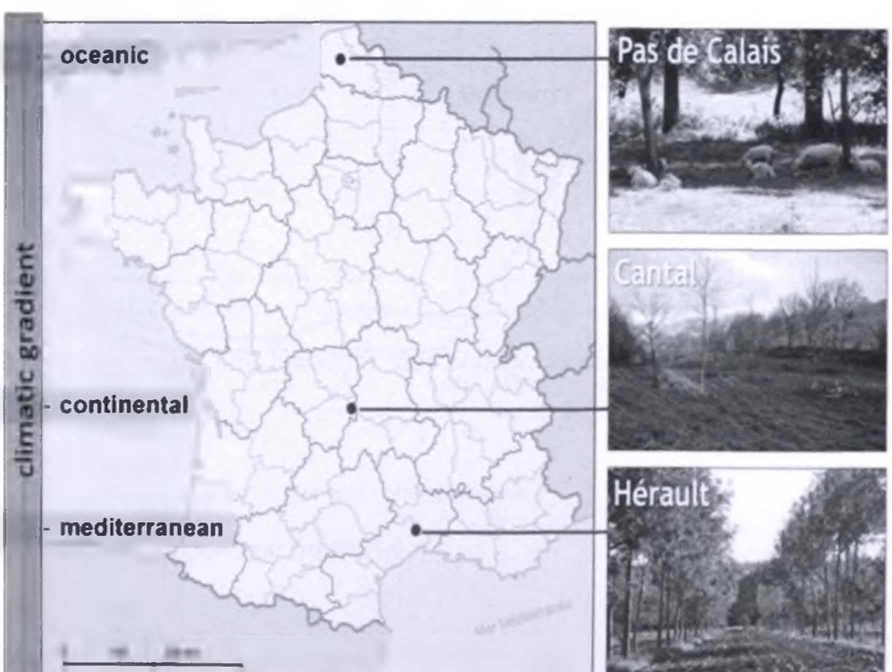

Figure1 The location of the three sites under a climatic gradient

Figure2: Methods used for measuring root dynamics in the three climates

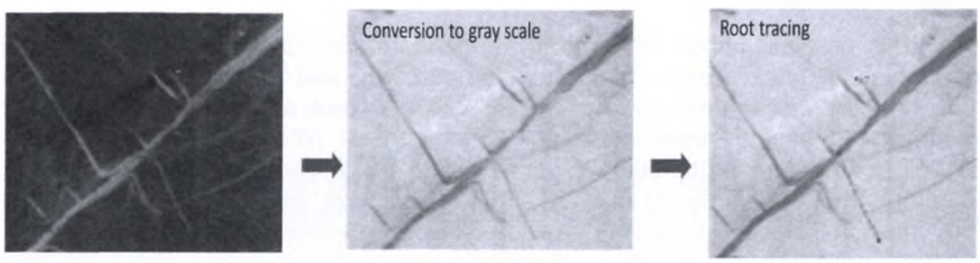

Figure.3: Image analysis in SmartRoot

Results

In our preliminary results, significant and positive correlations were found between mean fine root elongation rate and air temperatures (fig.4), and between root elongation rate (cm/day) and soil temperatures at the two depths of soil (10cm & 60 cm depth) (**fig.5 &6**) in the two climates (oceanic and continental) with higher correlation in the continental climate. During 2015, fine root elongation (mm) began in early May corresponding the budburst period, peaked during June and July, and almost ceased by mid-November with the leaf-fall in oceanic and continental climates (**fig.7**). Our preliminary results highlight that shoots and root phenology is synchronized in hybrid walnut in agroforestry systems whatever the climatic gradient.

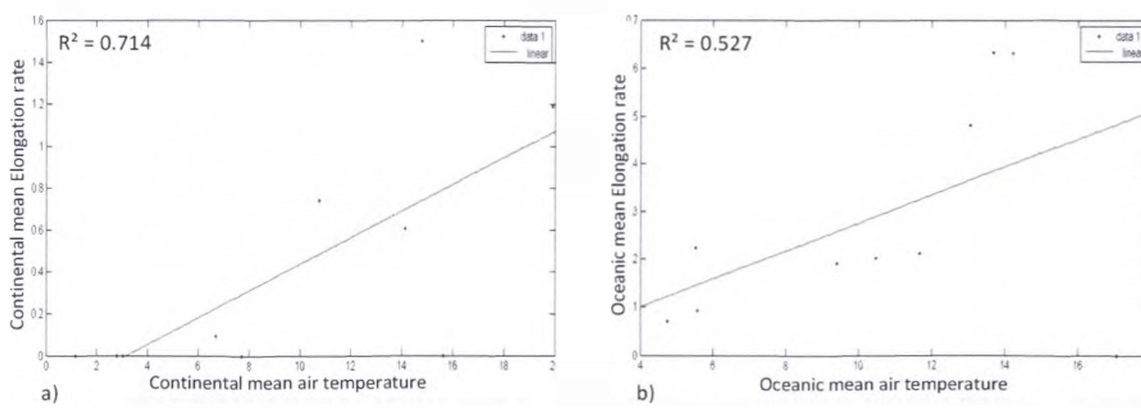

Figure 4: Correlation between root elongation rate (cm/day) and mean air temperature in a) continental and b) oceanic climates

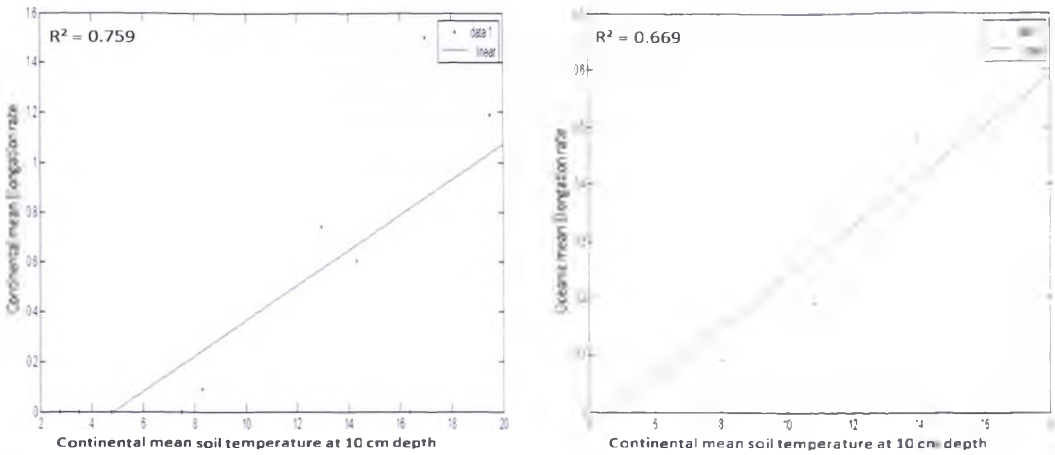

Figure 5: Correlation between root elongation rate (cm/day) and mean soil temperature at 10 cm soil depth in continental and oceanic climates

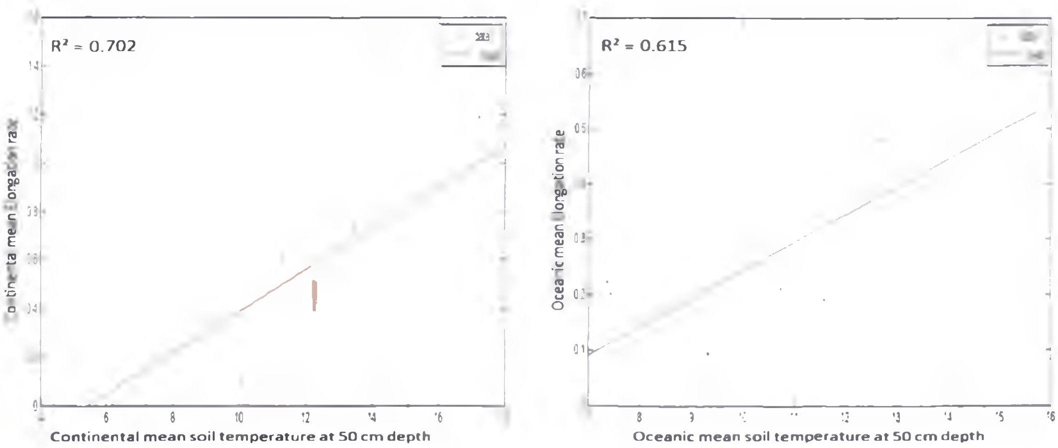

Figure 6: Correlation between root elongation rate (cm/day) and mean soil temperature at 50 cm soil depth in continental and oceanic climates

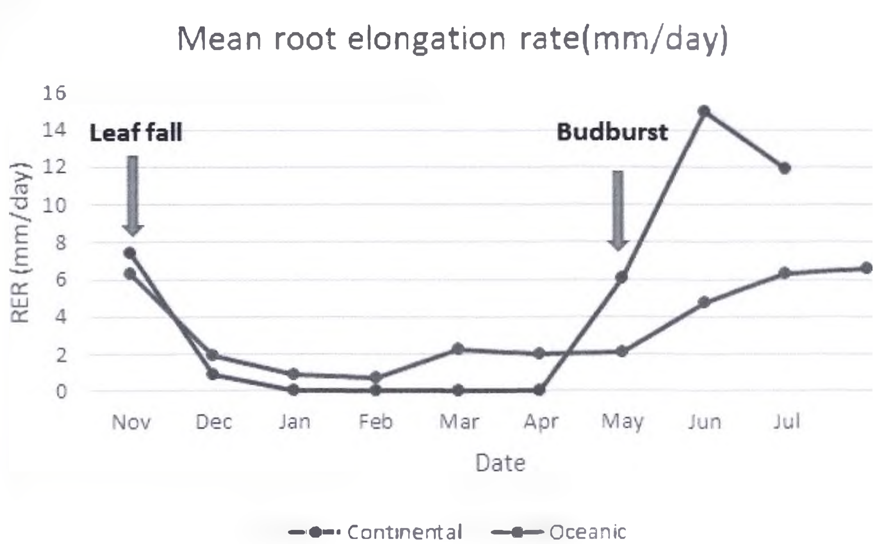

Figure7: Mean root elongation rate (mm/day)

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